3.8 ECM DECEPTION ON-BOARD

RADGUNS implements several deception ECM techniques. Inverse Gain is an angle deception jamming technique that operates against CONSCAN threat radars and is implemented in *RADGUNS* using the following procedure:

a. The target detects the radar's signal.

b. The minimum and maximum of the received radar signal is computed to find the scan period.

c. The signal envelope is inverted.

d. The jammer amplifies and clips the signal, transmitting the result only when the inverted signal is positive.

Subroutine SWEPTA in *RADGUNS* simulates a Swept Audio (SWA) jammer whose signal may be amplitude modulated. The jammer on-off frequency is linearly swept across a user-specified frequency range. The swept audio jammer power signal amplitude is calculated at the threat radar receiver antenna as a function of time. The jammer output power is calculated by multiplying the jammer power by the jammer transmitter antenna gain including the effects of a one-way path loss. Bandwidth effects are accounted for by multiplying by the ratio of the threat radar bandwidth to the jammer signal bandwidth. The threat radar receiver routine performs any signal frequency filtering of the jamming signal. The jammer output voltage will be sinusoidally modulated if a non-zero modulation percentage was set in the input parameter file. Sweeping over a range from half the scan frequency to twice the scan frequency should be sufficient to induce tracking errors in the radar.

For Simple Repeater (RPTR) jamming, the pulse received from the threat radar is amplified by the jammer receiver antenna gain, the jammer internal gain, and the jammer transmitter gain. The transmitted pulse is a delayed version of the received pulse. A repeater jammer can be used in conjunction with the RGWO jammer to provide a hook pulse for the RGWO jammer.

Subroutine RGWO in *RADGUNS* simulates a range-gate walk-off jammer whose signal may be amplitude modulated. The simulation of the transmission of a range-gate walk-off jammer operates against the threat radar's range track gate. The jammer power is calculated and stored as a function of time. The amount of RGWO at the radar receiver antenna is calculated by multiplying the received radar signal by the jammer internal gain and the jammer transmitter antenna gain. Bandwidth effects are accounted for by making power a function of jammer frequency. One function of the threat radar receiver is to filter all incoming signals according to frequency.

Data Items Required

Data Item		Accuracy	Sample Rate	Comments
1.3.2.1.1	Jammer power		SV/T	
1.3.2.1.2	Jammer bandwidth		SV/T	
1.3.2.1.3	Target signal		SV/T	
1.3.2.1.4	Jammer signal		SV/T	
1.3.2.1.5	Burn-through range		SV/T	
1.3.2.1.6	Jammer antenna gain		1 deg Az by 1 deg El/step	
1.3.2.1.7	Jammer angle		10 Hz	
1.3.2.1.8	Detection time		SV/T	
1.3.2.1.9	Time amplitude modulation		10 Hz	10 s intervals
1.3.2.1.10	Frequency		10 Hz	10 s intervals
1.3.2.1.12	Phase		10 Hz	
1.3.2.1.13	Angle error		10 Hz	
1.3.2.1.14	Range error		10 Hz	

3.8.1 Objectives and Procedures

The RGWO deception jamming function of *RADGUNS* is sensitive to changes in internal jammer gain. *RADGUNS* was executed with the following input conditions:

a. Model mode: SNGL/RADR
b. Target RCS: 1 m^2
c. Target altitude: 1000 m
d. Flight path: LINEAR
e. Jammer type: RGWO
f. Jammer internal gain: 20, 30 dB
g. Jammer antenna gain: 10 dB
h. Jammer bandwidth: Radar receiver bandwidth
i. Output: Range tracking errors over time

3.8.2 Results

Figure 3.8-1 shows the effect of internal jammer gain on range tracking error. RGWO is the product of jammer internal gain, jammer transmitter antenna gain (modeled as a straight gain rather than as a function of angle off boresight), and the received radar signal. The maximum jammer output power is limited by the user. For a jammer internal gain of 20 dB, the range gate is pulled off approximately 8 meters before reaching the maximum walk-off time. The jammer then turns off for a specified period of time. A 20 dB internal jammer gain is not enough to cause the range tracker to break lock on the target. With an internal jammer gain of 30 dB, the range gate is pulled off 59 m before the range tracker breaks lock. The tracker then goes into reacquisition mode for 3 s.

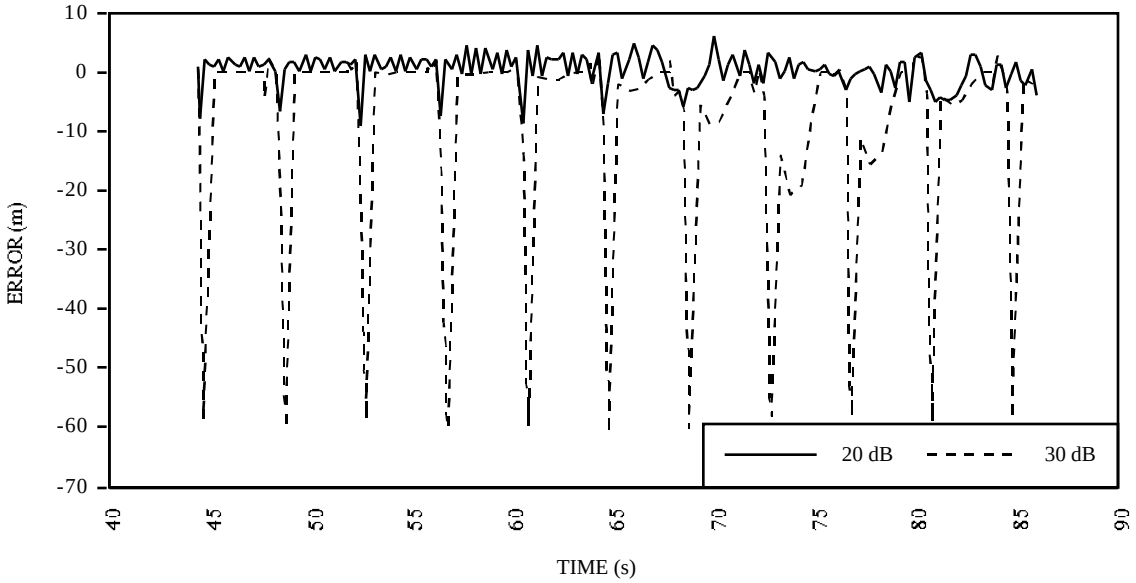

FIGURE 3.8-1. Effect of Internal Jammer Gain on Range Tracking Error.

3.8.3 Conclusions

RGWO deception jamming is sensitive to changes in internal jammer gain, all other factors being constant. As shown in Figure 3.8-1, an internal jammer gain of 20 dB pulls the range gate off slightly while a 30 dB gain causes break lock and reacquisition. Due to the significant impact of internal jammer gain on range tracking performance, it is recommended that internal jammer gain be measured to within 1 dB accuracy. Jammer antenna gain is also modeled as a straight gain, and must be measured to the same accuracy as the internal jammer gain.

To ensure a valid assessment of the swept audio jamming technique, the frequency of the jammer signal must be known to within 2 Hz for the system of interest. To ensure an out-of-phase inverse gain jamming signal, an additional e requirement is applicable to the inverse gain jamming technique.